ART. XX.—*A Manual of Chemistry. By William Thomas Brande, Secretary of the Royal Society of London. The first American from the second London edition. Three volumes in one. To which are added, Notes and Emendations. By William James Macneven, M. D. Professor of Chemistry in the College of Physicians and Surgeons of the University of the State of New-York.* New-York, 1821. pp. 638.

THE establishment of the laboratory of the royal institution of Great Britain will ever be considered as a memorable epoch, in the history and progress of chemical science. While the bounds of knowledge were rapidly extended by the powerful genius of the illustrious individual, who first occupied the chemical chair, the lecture rooms were crowded, and a taste for scientific research was excited, resulting in benefits the most important, not only to the immediate attendants on the lectures, but to the nation and to the world at large. To the investigations conducted under the patronage and within the walls of the royal institution, not only is the chemist indebted for the confirmation of many facts, for the development of new and powerful agents, and for many of the brilliant discoveries with which the science has been enriched; but incalculable benefit has been conferred upon the artist and manufacturer; while the natural philosopher, the botanist, and the mineralogist have seen a taste for their favorite studies assiduously cultivated and widely diffused. In the apartments of the royal institution, observes professor Brande, 'the intercourse which has been facilitated between patrons of science, scientific men, and the promoters of manufactures and arts, has tended to inspire that activity and energy which spring most luxuriantly from the free interchange of opinion.'—'Diffusing on one hand the elements of science to crowds of the fashionable world, who were delighted at the new source of instructive amusement thus opened to them, and on the other maintaining an honorable and emulous contest with the profoundest philosophers of the age in the paths of discovery and experiment, the royal institution rose to a height of distinction which has been rarely attained.'

Our readers are probably aware that the royal institution is not merely a school of chemistry, but that the great object for

which it was established is the advancement of every branch of science; and that within its walls gentlemen of the first talents lecture on practical mechanics, architecture, antiquities, drawing and painting, on botany and the other departments of natural history. The lectures are illustrated by an ample chemical and philosophical apparatus, and the library, the mineralogical cabinet, and the collection of models are of great value and extent.

The work, the title of which is prefixed to this article, professes to be an abstract of the lectures of professor Brande; who, on the resignation of Sir Humphry Davy, was chosen to succeed to the chemical chair in the institution. We have taken this opportunity of alluding to it, in consequence of the new prospects which private munificence has opened upon an establishment in this town, of which we have every reason to be proud, and with which we trust every aid and incentive to the promotion and diffusion of literature and science will before long be connected.

The work of professor Brande has been favorably received in Europe, and most of our readers must be fully satisfied of its merits, from the notice which has been taken of it in so many of the European journals. We congratulate our scientific friends on the republication of the work in this country, and cheerfully recommend it to chemical students, who will find in it a clear and satisfactory view of the present state of the science of which it treats. It will moreover be found to contain many details in regard to the manipulations of chemistry, which they will in vain seek in more voluminous and elaborate treatises. It is admirably well calculated for those who are commencing the study of chemistry, and that portion of it which relates to analysis, will be found particularly useful to all, who undertake operations of this kind. Those who are desirous of pursuing any subject more in detail than has been done by Mr Brande, will find numerous references, at almost every page, to the best and latest authorities.

While we express our approbation of this work, we feel under the necessity of saying, that the American editor has rather imperfectly performed the office he undertook of adding 'notes and emendations.' The whole amount of his labors, as far as we can discover, consists in the adaptation of the representative numbers for the elementary and compound atoms, to the determinations of Prout and Thomson, the omission of one

hundred and eighty-eight pages of preface, and the abridgment of one hundred and two pages of index to two! The fact that the principal part of the preface to the English edition is but an enlarged, though in several particulars an improved version of the author's earlier dissertation on the progress of chemical science, already published in this country, appears to us an inadequate apology for its omission. In regard to the abridgment of the index, we feel still more disposed to complain, having in vain sought for some of the most important topics of discussion in the meagre table of two pages retained. A well digested index to a work of this kind is not only convenient, but we had almost said, an essential part of the treatise itself.

In that portion of the preface which Dr Macneven has seen fit to retain, we are told by professor Brande that the arrangement of the materials of his volumes is that, which 'some years' experience of its advantages in teaching the principles of the science,' has induced him to adopt. 'In the present state of our knowledge,' he continues, 'it will be found most convenient to begin with the discussions relating to the general powers or properties of matter, and afterwards to proceed to the examination of individual substances, and to the phenomena which they offer when presented to each other under circumstances favorable to the exertion of their mutual chemical agencies.' The leading facts connected with the general laws of chemical changes are then detailed in a clear and satisfactory manner, under the heads of 'homogeneous attraction, heterogeneous attraction or affinity, heat, and electricity.'

In the following chapter 'the properties of radiant matter, and its influence upon the composition of bodies,' are considered. The effects of radiant matter, in producing the phenomena of vision, are not, however, dwelt upon at sufficient length, and the student, we fear, will obtain from this part of professor Brande's work but a very superficial knowledge of the equally curious and beautiful phenomena, connected with the polarisation of light. We should have been pleased to have seen a more complete analysis of the labors of Dr Brewster on this subject, especially as for a few years past it has excited so much attention among the philosophers of Europe. We may indeed say, that chemists and mineralogists are just beginning to avail themselves of its powerful aid in the prosecution of their respective sciences. The labors of Malus, Brewster,

Arago, Biot, and a few others, have reduced the apparently intricate and variable phenomena of double refraction and polarisation 'under the dominion of general laws,' and have enabled us to calculate them, in the language of Dr Brewster, 'with as much accuracy as that, with which the astronomer can compute the motions and positions of the heavenly bodies.' It must be gratifying to mineralogists to learn that the results of the investigations of Dr Brewster are about to be applied to the classification of minerals, and that that gentleman is preparing a work, founded chiefly on the physical relations of minerals, and on the characters derived from optical phenomena, and the action of crystals on *polarised light.*

The third and fourth chapters are devoted to 'the sources and properties of the simple supporters of combustion, and of the elementary acidifiable substances, and their mutual combinations.' In the section on carbon, the magnificent diamond mentioned by Tavernier is noticed as probably the largest known. It is of the size of a hen's egg, and weighs $279\frac{9}{10}$ carats;—before cutting, it weighed 900 carats. This, however, is far exceeded by a diamond not noticed by Mr Brande, of which the following account, from the third edition of professor Jameson's mineralogy, may not be uninteresting. This diamond 'is said to be in the possession of the rajah of Mattan, in Borneo, in which island it was found about eighty years ago. It is egg-shaped, with an indented hollow near the smaller end. It is said to be of the finest water. It weighs 367 carats. Now, as 156 carats are equal to one ounce Troy, it is obvious that this diamond weighs two ounces 169.87 grs. Troy. Many years ago the governor of Borneo attempted to purchase this diamond. He sent a Mr Stewart to the rajah, who offered 150,000 dollars, two large war-brigs, with their guns and ammunition, together with a certain number of great guns, and a quantity of powder and shot. The rajah, however, refused to deprive his family of so valuable a hereditary possession, to which the Malays attach the miraculous power of curing all kinds of diseases, by means of the water in which it is dipped, and with which they imagine that the fortune of the family is connected.'

In the section to which we have just alluded, Mr Brande has given a brief sketch of the operations connected with the application of coal gas to the purposes of illumination. As this mode of lighting streets and buildings has been attempted

in various places in this country without success, arising in a great measure from the high price of coal, we beg leave to call the attention of the enterprising and speculative to the apparatus for the conversion of *oil* into gas. It appears that the commonest and most impure kinds of whale or other oils, which are quite unfit for burning in the usual way, 'afford an abundance of excellent gas, requiring no other purification than passing through a refrigerator, to free it of a quantity of empyreumatic vapor. A gallon of whale oil affords about 100 cubical feet of gas, and an Argand burner, equal to seven candles, consumes a cubical foot and a half per hour.' The cost of a lamp fed by oil gas, and giving the light of seven candles, is stated at three farthings per hour 'of Argand's lamp,

with spermaceti oil,	- - -	3d.
mould candles,	- - -	$3\frac{1}{2}$d.
wax candles,	- - -	14d.'

Mr Brande has ascertained, 'by a series of experiments, conducted with every requisite caution, that, to produce the light of ten wax candles for one hour, there were required

2600	cubical inches of carburetted hydrogen or olefiant	gas,
4875	- - - - - -	oil gas,
13120	- - - - - -	coal gas.'

The fitness of the gas obtained from coal is dependent on the quantity of carburetted hydrogen, or olefiant gas, contained in it, and 'the fitness of the purified mixed gas for illumination, will be directly as its specific gravity.' It has been proved by experiment, that 'purified *coal gas* seldom contains more than 40 *per cent.* in volume of carburetted hydrogen, while *oil gas* generally affords about 70 per cent.; hence its superiority for burning and the relatively small quantity consumed.' The gas is obtained by decomposing the oil, and for this purpose a very simple apparatus is required, consisting of 'a furnace with a contorted iron tube, containing fragments of brick or coke,' and the oil is suffered to drop into this. The oil 'is converted almost entirely into charcoal, which is deposited in the tube, and into a mixture of carburetted hydrogen, and hydrogen gases, of which from two to three cubic feet may be regarded as equivalent to five or six of coal gas, for the production of light.'

The fifth chapter of the work before us embraces the metals and their compounds. In the section on nickel we find rather a meagre account of aërolites or meteoric stones. The ter-

restrial formation of these bodies, Mr Brande considers as disproved by the most satisfactory and indisputable evidence. The opinion to which he inclines, in regard to their origin, will be evident from the following quotation.

'To account for these uncommon visitations of metallic and lapideous bodies, a variety of hypotheses has been suggested. Are they merely earthy matter, fused by lightning? Are they the offspring of any terrestrial volcano? These were once favorite notions; but we know of no instance in which similar bodies have in that way been produced, nor do the lavas of known volcanoes in the least resemble these bodies; to say nothing of the inexplicable projectile force that would here be wanted. This is merely explaining what is puzzling, by assuming what is impossible; and the persons who have taken up this conjecture, have assumed one impossibility to account for what they conceive to be another, namely, that the stony bodies should come from any other source than our own globe.

The notion that these bodies come from the moon is, when considered, neither absurd nor impossible. It is quite true, that the quiet way in which they visit us is against such an origin; it seems, however, that any power which would move a body 6000 feet in a second, that is, about three times the velocity of a cannon ball, would throw it from the sphere of the moon's attraction into that of our earth. The cause of this projective force may be a volcano, and if thus impelled, the body would reach us in about two days, and enter our atmosphere with a velocity of about 25000 feet in a second. Their ignition may be accounted for, either by supposing the heat generated by their motion in our atmosphere sufficient to ignite them, or by considering them as combustibles, ignited by the mere contact of air.

While we are considering the *possibility* of these opinions, it may be remembered, that in the great laboratory of the atmosphere, chemical changes *may* happen, attended by the *production* of iron and other metals; that, at all events, such a circumstance is within the range of possible occurrences; and that the meteoric bodies which thus salute the earth with stony showers, may be children of the air, created by the union of simpler forms of matter. The singular relationship between iron and nickel and magnetism, and the uniform influence of meteoric phenomena on the magnetic needle, should be taken into account in these hypotheses.'

Neither professor Brande nor the American editor, has taken any notice of the theory proposed by president Clap, of Yale college. He supposed that meteors 'are small terres-

trial comets revolving about the earth in the same manner as the solar comets revolve about the sun. That moving in very eccentric orbits, when in perigee, they pass through the atmosphere, are highly electrified, and consequently become luminous. As they approach their lower apside, their electricity is discharged, the body disappears, and a report is heard. This being admitted, it is not strange that, by the violence of the shock, portions of the meteor should be thrown to the earth, while the main body, not sensibly affected by so small a loss, continues to move on in its orbit, and of course ceases to be luminous.' (Amer. Philos. Trans. Vol. 6.) We are aware of the objections to this hypothesis, and that it has been ably discussed by Dr Blagden. But when we consider that it was started before the modern discovery of the four small planets, before the discovery of a comet with a period of only twelve hundred days, of which we gave an account in our last number, and before the discovery of a revolving transparent nebulous substance made by Dr Olbers, and mentioned in this journal for April 1820, we think president Clap's conjecture does him great credit, and that it required far greater reach of speculation than it would now do.

In the sixth chapter of the work under review, there are many valuable details respecting the analysis of metalliferous compounds, in which the author, as he candidly acknowledges, has availed himself largely of the invaluable analytical labours of Klaproth and others. The correctness of these processes appears to have been, for the most part, 'submitted to the test of experimental repetition in the laboratory of the Royal Institution.' We find many judicious remarks in regard to the difficulties and fallacies by which the young analyst is too apt to be discouraged, and fully agree with our author, that 'the practice of submitting substances of known composition to analysis, cannot be too strongly recommended to the chemical student. It makes him acquainted with the mutual actions and habitudes of a number of bodies which experience can alone teach, and gives a dexterity of manipulation and an accuracy in conducting experimental inquiries, of which he will find the value when subsequently in the pursuit of original investigations.'

We were not a little surprised to see the blow-pipe of the old form, the application of which is exceedingly difficult to be acquired, recommended for general use. No notice is

taken of the improved instrument of Mr Brooke, which, though not quite so portable as the former, is on every other account to be preferred; nor is there any description of the more powerful apparatus of our ingenious countryman, professor Hare. These omissions of Mr Brande should by all means have been supplied by the American editor.

The seventh chapter on the analysis of mineral waters, is preceded by a plan and description of a portable laboratory, which will be found highly convenient for all the necessary operations in these interesting and important researches. Mr Brande has not adverted to the mode of analysis recommended by the late Dr Murray, 'because', as he observes, 'I cannot admit the existence of incompatible salts to the extent which his principle requires.' The student is referred for a variety of useful details to the works of Drs Marcet and Scudamore; Messrs Phillips and Thenard.

The objects of the eighth chapter are the formation of vegetable substances and their chemical physiology, the analysis of vegetable products and the properties of their proximate component parts, and the phenomena and products of fermentation. The ninth chapter is devoted to the subject of animal chemistry.

The remainder of the volume is principally geological, and is in fact a reprint of the author's 'Outlines of Geology,' published in 1817. An account of the principal chemical characters of minerals is an important part of every treatise on chemistry, but we are disposed to consider the introduction of geological speculations as superfluous. As these sections, however, have been retained by the American editor, we should have been pleased to have seen those additions and 'emendations,' which they so evidently require. We have not found a reference to a single locality of American minerals, nor to any of those points in the geological structure of this country, which might, with very little labor, have been added. Such additions would have rendered this part of the work far more interesting and valuable. Professor Brande evidently inclines to the Huttonian hypothesis, in regard to the origin of rocks, but has given an interesting and perspicuous abstract of the opinions of other geologists most entitled to attention. The following is his description of a set of rocks, which from personal examination, we know bear a great resemblance in structure to some in the vicinity of this

town, and to which we alluded in the number of this journal for October, 1820.

'Before we quit the subject of primary rocks, it will be right to mention a district of Britain, which, for grandeur of scenery and geological interest, can, I think, scarcely be surpassed. I allude to the country between the eastern extremity of Lochness and Fort George, and especially to the rocks over which the river Fyers pursues its turbulent and winding course.

'These are seen in characteristic grandeur in the neighbourhood of the small inn, called the General's Hut, and the scenery becomes more and more impressive and interesting, until we arrive at the celebrated falls of the river. I should call the rock a *granitic breccia*, or *conglomerate;* it appears made up of numerous angular,' and we beg leave to add, *rounded* 'fragments of granitic materials, held together by a silicious cement, and the aggregate is of extreme hardness and durability; masses resembling jasper and agate may also be observed in it.

The general features and rugged irregularities of this district, continues Mr Brande,

'Considered conjointly with the peculiar texture and composition of the materials that form it, present many objects worthy the attention of some geologist, and may be regarded as recording some great natural convulsion, which has not only broken up and reunited certain primary rocks, but has again disturbed their tranquillity, and thrown them into the stupendous confusion they now exhibit.'

The geological part of Mr Brande's work is embellished with a number of engravings, the principal part of which are reduced copies of the admirable sketches of Dr Maculloch, in the Transactions of the Geological Society of London.

Mr Brande takes but a brief notice of volcanoes, and considers that, from the discoveries of sir H. Davy, we may 'deduce a very adequate solution of the problem of volcanoes, for we have only to suppose the access of water to large masses of those peculiar metals which constitute the alcaline and earthy bases, and we are possessed of all that is wanted to produce the tremendous effects of earthquakes and volcanoes; for what power can resist the expansive force of steam, and the sudden evolution of gaseous fluids, accompanied by torrents of the earths in igneous fusion, which such a concurrence of circumstances would give rise to, and which are the actual concomitants of volcanic eruptions?"

Upon the analysis and composition of soils, Mr Brande has extracted largely from sir H. Davy's Elements of agricultural chemistry. This is a subject of great importance to the practical agriculturist, and is, we are happy to observe, attracting the attention of gentlemen in this country. An examination of the geological structure of any district of country, will be found of essential advantage in promoting the most efficient methods of culture. In illustration of this remark we refer our readers to a valuable paper of Dr Paris, in the 1st Vol. of the Trans. of the Geolog. Soc. of Cornwall. 'The line of junction,' observes Dr Paris, 'between the granite and slate formations, may, in many parts, be traced by the eye alone, through tracts of cultivation, from the remarkable fertility which attends it. It may be defined a *zone of fertility.*' Mr Worgan in his view of the agriculture of Cornwall has also noticed a district of great fertility, at the junction of granite and slate. Again, Dr Paris tells us that he was requested by a friend 'to examine whether any geological arrangements could explain the cause of a particular line in his estate, being more fertile than the neighbouring lands; upon tracing the direction of the granite and slate formations, we soon discovered that this line of superior fertility was superincumbent upon the junction of these rocks.' During the summer of 1816 in a geological excursion around the peninsula of the Lizard, Dr Paris was accompanied 'by a very intelligent farmer of that district, who informed him that the *killas* (or clay slate) and *growan** lands as they came together were much improved in quality, and that they were mutually increased as much as one third in value; he also stated that the crops upon this "*rich vein*" were much earlier.'

Art. XXI.—*A geological and agricultural survey of Rensselaer county in the state of New York. Taken under the direction of the honorable Stephen Van Rensselaer.* Albany, 1822. pp. 70.

The importance of geological and agricultural surveys, at which we have hinted in the preceding article, is beginning to be duly estimated in this country, and a most praiseworthy example has been given by Mr Van Rensselaer of New York,

* The provincial name for decomposed granite.

ERRATA.

Page 362, last line, *dele* the stop at the end.
" 375, 5th line, *for* ' apside,' *read* ' apsis.'
" 396, 1st " " ' these,' " ' those.'